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ABSTRACT

The purpose of this study was to test associative skills by means of a paired-associate task with varied mediational instructions. Subjects were 84 first grade ghetto children, 25% of whom were from Spanish-speaking homes; virtually all the other subjects were black. The 3 x 2 x 4 factorial design included: three mediation sets (imagery, verbalization-sentences, and verbalization-naming), two ability levels (mediational ability and production ability), and four trials. A control group was tested for spontaneous production. Results indicate that performance was better (a) under the sentential and imagery sets than under the naming set, (b) when mediational rather than production ability was required, and (c) on later trials, although rate of learning varied by condition. An interaction of mode, elaboration, and ability was found. Results suggest the same patterns of mediational ability obtain for first graders from ghetto and white middle class backgrounds. The interaction of mediational deficiency with mediation set requires the revision of the stage model of mediational deficiency. (Author/NH)

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THE EFFECT OF MEDIATIONAL INSTRUCTIONS ON ASSOCIATIVE SKILLS OF FIRST GRADE INNERCITY CHILDREN[1]

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The study which I will present deals with the mediational skills of first grade ghetto children. These skills were investigated by varying the instructions given, and by supplying or not supplying an elaborating mediator.

Three or four years ago, a discussion of mediating processes in children would probably have centered around a stage-theory approach. Support for a stage theory had come from several different lines of research. Luria had first proposed a three-stage model of mediational development in 1958. Kendler's work (1963) on the reversal-nonreversal shift--using a nonverbal task--had led her to suggest a three-stage model as well. Flavell, Beach, and Chinsky's work (1966) with a serial learning task led them to modify this model. These tasks had involved labeling; that is, they involved verbal mediation. Flavell (Keeney, Cannizzo, and Flavell, 1967) suggested that mediational age-stages should apply to non-verbal mediation as well.

As Flavell is considered a leading proponent of the stage-theory approach to mediation, a closer look at his definition of these stages might be in order. He defines the preschool

[1]Paper presented at the meeting of the A.E.R.A. March 1970, Minneapolis.

"mediational deficiency" stage as the period when the child may know the relevant verbal label for the concept, object, etc. to be learned, but this label has no mediational power. In the subsequent "production deficiency" stage, he may be able to use supplied mediators effectively, but he lacks the ability or propensity to produce them in the given task (Flavell et al., 1966). Stage theory thus maintains that preschoolers exhibit a mediational deficiency for verbal--and probably non-verbal--mediators, while five-to-seven-year-olds exhibit a receding production deficiency for these mediators.

Today, this approach must be considered simplistic or at least, incomplete. This is because the very recent results of a different line of research tell us that the development of mediational skill is a much more complex phenomenon. For many years, verbal and imaginal representation had been considered to be two separate symbolic processes, with the latter preceding the former in development. This treatment occurs in the writings of Freud (Ford and Urban, 1965), and of such contemporary cognitive theorists as Bruner (1966) and Piaget (e.g., Piaget and Inhelder, 1966). But Paivio, who has pioneered the study of imagery among adults (see Paivio, 1967,

for a review) has recently suggested that imaginal and verbal modes of representation may be <u>additive</u> in effect (Paivio, 1969). This, in turn, suggests a need to integrate the available data on children's imagery and verbalization into any existing mediational theory, including stage theory.

As it happens, there is a rapidly growing body of data on mediated learning in children, involving both imaginal and verbal mediation. These studies have largely been conducted in a verbal learning framework and involve the learning of pairs of pictures or words.

Three main variables have been used in these studies: the pictorial or verbal properties of the task material, the degree of elaboration of the task material, and age. The results of these studies indicate a main effect of degree of elaboration and age but, more importantly, a complex interaction of mode of representation, degree of elaboration, and age. In a recent symposium on imagery, for example, Rohwer(Reese, 1969) noted, "the capacity for deriving benefit from pictorial modes of representation develops later than the capacity for deriving benefit from verbal modes (p. 25)." And discussing the effect of elaborations of items, he added, "action imagery, by itself, adds a positive effect on learning, but . . . the capacity for developing full benefit from such imagery develops later than the capacity to benefit from analagous verbal

elaborations (p. 36)."

The fact that performance varies with mode of representation, degree of elaboration, and age creates certain problems. First, it suggests trouble for the existing mediational stage theory. In addition, the mode-elaboration-age interaction makes it difficult to measure mediational ability and mediator efficacy independently of each other. Thus performance involving elaborated imagery, for example, is affected by both the ability to utilize or produce the mediator and the efficacy of this mediator.

At this point, a restatement of the research problem might clarify the issue before us, and suggest what additional research is needed. Children's learning is apparently facilitated by mediation along two (possibly additive) modes of representation, imagery and verbalization, to the extent that the child utilizes or elaborates the contextual meaning of the item, and by the efficacy of the mediator used. The research problem, viewed in this light, does suggest a somewhat different approach to studying mediational skills. We now need developmental tests of children's <u>ability</u> to utilize, produce, or spontaneously adopt a production strategy for various levels of elaboration in either or both modes, given verbal or pictorial material. (This approach might also clarify the relative efficacy of various types of mediators at given age

levels). In order to control mediating behavior, explicit mediational instructions would need to be used.

The current study is an initial attempt to test this research approach at a given age level. A group of first graders was chosen since their ages fall at the end of Flavell's second stage of mediational deficiency. Almost all of the previously mentioned research has involved white middle class children, for whom predictions on mediational ability could thus be made. However, studies of paired-associate learning indicate children of different ethnic and SES backgrounds have comparable performance on early trials (Rohwer, Levin, Lynch, and Suzuki, 1968; Semler and Iscoe, 1963). Thus the predictions for white middle class children should apply to a ghetto sample as well. We decided to use a ghetto sample in order to extend the data on mediational skills to this important but often overlooked population.

The present study was designed first to test varying mediational instructions as an effective method of studying mediational ability and relative efficacy; second, to test the utility of the two-stage mediational theory whose second stage occurs between the ages of about five to seven; and finally, to explore mediational ability and efficacy among ghetto first graders. The design employed varied mediational sets, levels of mediational ability, and trials in a paired-associate picture

PS 003105

task. Ability was tested under instructions to produce three kinds of mediating set--imagery, verbalization involving sentences, and verbalization involving names.

Predictions in the current study were based on the results of previous studies using other experimental approaches. These results, relating to mediational ability and apparent efficacy, are summarized in Table 1. Main effects of mediation set, ability tested, and trials were predicted, and an interaction of mediational set and ability.

With regard to mediational set, performance under imagery and sentence instructions was predicted to exceed that under naming instructions. With regard to ability tested, performance under mediator-supplied and production-instructed conditions was predicted to exceed performance requiring spontaneous production. An interaction of mediational set and ability would not be predicted from the two-stage model of mediational development, but seemed warranted by the experimental data. The predicted interaction is apparent in the expected results of planned comparisons of experimental and control conditions.

These planned comparisons were predicted to show a superior level of performance for sentence and imagery mediation when the mediators were supplied or subjects (Ss) were instructed to produce them. An inferior level of performance was predicted under both types of naming instructions. The control condition

was predicted to produce performance equivalent to naming but inferior to sentence or imagery instructions since spontaneous production of labels--but not sentence or imagery mediators--has been found at this age. These predictions are based on data collected on middle class white Ss, but are expected to apply to a ghetto population as well.

METHOD

Design

The current study employed a paired-associate task and a 3x2x4 factorial design with repeat measures on the third factor. The first of these variables was mediation set. Subjects were instructed and trained to use imagery, sentences, or labels to learn the picture pairs. The second variable was ability tested. In the test of mediational ability, a mediator, or "elaborator," was supplied. The elaborator was a compound picture, a sentence, or the names of pictured items, depending on the mediation set. In the test of production ability, no mediator was supplied. Combinations of these two variables, mediation set and ability tested, resulted in six experimental conditions:

Condition A--imagery instructions given and compound pictures supplied;

Condition B--imagery instructions given and no elaborator supplied;

Condition C--sentence instructions given and sentences supplied;

Condition D--sentence instructions given and no elaborator supplied;

Condition E--naming instructions given and picture names supplied;

Condition F--naming instructions given and no elaborator supplied.

As a test of spontaneous production, a seventh control condition was added: Condition G. Under this condition, no special mediating instructions were given, and no elaborator supplied.

The third variable used was trials. Each subject's performance was measured on four consecutive trials.

The dependent variable was the number of paired associates, from 0 to 10, correctly recalled on each trial.

Two experimenters (Es) were used, a same-culture E and an other-culture E. In this study, the same-culture E was Negro, the other-culture E, white. Each E tested an equal number of boys and girls within each condition. Results were pooled across Es and across sex of child within each condition.

Subjects

A total of 84 Ss, half boys and half girls, took part in the study. These Ss were block randomized by sex among

Conditions A through G, resulting in 12 Ss, 6 boys and 6 girls, in each condition.

The Ss were drawn from the classes of cooperating first grade teachers in a ghetto school on Chicago's South Side. Ss' mean age was 7.0 years, the standard deviation, 4.7 months. Kuhlmann-Anderson intelligence test scores, available for 85% of the Ss, averaged 101.3, the standard deviation, 7.1 points. Inconclusive test results had been obtained for the remaining 15% of the Ss, suggesting that mean I.Q. was actually lower than 101, but by an indeterminate amount. The relatively high I.Q. of the sample was not considered to affect the generalizability of the results, since the studies of Rohwer(1966) and Semler and Iscoe (1963) indicate that paired-associate performance is negligibly correlated with I.Q. scores for low SES children.

Twenty-five percent of the Ss were from Spanish-speaking homes (i.e., one or more of the parents had been born in a Latin-American country, usually Puerto Rico). Virtually all the remaining Ss were Black.

Materials

Task materials included 20 pictures of common objects, randomly combined into 10 pairs (Table 2). The objects were selected from a list of nouns rated by adults for concreteness, imagery-evoking capacity, and meaningfulness (Paivio, Yuille,

and Madigan, 1968). The 20 nouns selected were high in concreteness and imagery, and uniform with regard to meaningfulness.

Line drawings of the objects were presented side by side on 7 in. by 14 in. cards. These cards were used in the instruction trials, study trial, and test trials with one exception, in Condition A. You may recall that in Condition A, imagery instructions were given and a mediator supplied. The supplied mediator took the form of an action picture, that is, of two line drawings presented as one compound drawing. These cards with a compound picture were used only in the instruction trials and in the study trial for Condition A, not in test trials.

Procedure

The Ss were individually tested on one of four non-consecutive days late in the school year. The task was introduced as a picture game with prizes, where the object was to learn which two pictures always went together. Jelly beans were used as prizes. Three training trials, one study trial, and four anticipation trials followed. During training, special mediation instructions were given to the experimental groups. Otherwise, the usual paired-associate instructions were given to all Ss. Training included a study period and one

anticipation trial for each of three paired associates that did not reappear in the actual task. These training trials were unpaced and elaborated upon until the E was confident the S understood his mediation instructions. Ss were warned that the study material would be presented at a faster rate. During the study trial, each pair was presented for 5 sec., with a 2 sec. interpair interval. Four anticipation trials followed in immediate succession. The anticipation trials were presented at a 10:3 sec. rate with a 2 sec. interpair interval. That is, the stimulus term of each pair was presented for 10 sec. (or less, if a response was given), then both terms appeared together for 3 sec. Order of presentation for the study trial and all anticipation trials was randomized across and within Ss.

RESULTS

The mean numbers of correct responses per condition per trial are shown in Figure 1, and the results of a 3x2x4 analysis of variance of experimental conditions are shown in Table 3. The three main effects of mediational set, ability tested, and trials were all significant at the .01 level. The two first-order interactions involving trials were also significant at the .01 level. Further analysis of the main effects was as follows.

With regard to mediational set, imagery and sentence sets produced significantly better performance than the naming set ($p < .01$ and $p < .05$, respectively). With regard to ability, mediating ability was better than production ability. That is, Ss did better when supplied with a mediator (action images, sentences, or labels) than when instructed to produce their own. This finding had not been predicted.

With regard to trials, performance increased over trials. However, the first-order interactions involving trials indicate that differences in performance among mediational sets, and between abilities tested, changed as a function of trials. The second-order interaction, Mediational Set x Ability x Trials, fell just short of significance at the .05 level. The most striking effect of trials was in Condition B, where imagery instructions were given but no elaborated mediator supplied. Here, performance failed to increase after the second trial, and even fell somewhat.

The planned comparisons of the control and experimental conditions used a Newman-Kuehls (multiple range) test and a .01 level of significance. Comparisons of performance on the first and final trial showed consistent differences, which are shown in Table 4. Two levels of performance were obtained. A superior level occurred under both sentence conditions and the imagery condition where a mediator was supplied. An

inferior level resulted under both naming conditions, the control condition, and the imagery condition where a mediator was not supplied. Significant differences in performance were not found within either of these performance levels.

These planned comparisons confirmed the predicted interaction of mediational set and ability level. As shown in Figure 2, no mediational deficiency was found for any mediational set, a production deficiency was found only for imagery, and a spontaneous production deficiency was found for both imagery and sentence mediation.

Degrees of elaboration within or between modes of representation have not generally been classified in the literature. But if we think of the compound pictures used in this study as one degree of imagery elaboration, naming as one degree of verbal elaboration, and sentences as two degrees of verbal elaboration of the pictorial material used, our results indicate an interaction of mode, degree of elaboration, and mediational ability as well.

DISCUSSION

What do these results tell us? We began with three research objectives involving the experimental approach to mediational skill, the utility of the existing multistage mediation model, and mediational skills of ghetto children. Let's look at our

results in that order.

The use of varied mediational instructions appears to be an effective approach to studying mediational skill. Mediational behavior, at least on initial trials, appears to be controlled effectively by mediating instructions and training. Additional research using this approach might involve various populations at different age levels. A production deficiency for imagery and a spontaneous production deficiency for naming would probably be found at the Kindergarten level. A production deficiency for sentences should be found either at the Kindergarten or preschool level. Rate of forgetting once learning had been equated under different conditions would be profitable to investigate, as would be the effect of training on the spontaneous production of the more effective mediators.

Now, the question of efficacy versus ability. Although based on relatively few S, the within-condition performance curves suggest how we might be able to separate the effects of efficacy and ability by the use of the following working hypothesis.

Before a given mediational ability is present and again, after it is widely shared in a population, performance variance should be minimal. Once the ability is widely shared, a normal curve of performance--i.e., of mediator efficacy--should apprear. (This assumes the scaling system permits such a

distribution). Relatively high or low efficacy for a given mediator then would be reflected in mean score. During an ability's acquisition period, the performance curve would show greater variance, perhaps because of unevenness in mediator efficacy, but, more likely, because of unevenness of the ability's use within Ss.

In the current study, performance curves for the naming conditions in trial 1 (Figure 3) show a fairly normal curve and a rectangular distribution. Both show minimal variance compared with the other experimental conditions, and peak in the low end of the performance scale. To us, this indicates maturity of the abilities in question, with mean performance purely a result of efficacy. The less normal distributions and greater variance of the other performance curves indicate that these abilities are not as fully developed. The use of more Ss at a variety of ages would allow tracing changes in performance curves over time, and might suggest ways of testing this hypothesis.

Our second concern involved the stage model of mediation Just as Flavell showed two deficiency stages where only one had been thought to exist, so must we now acknowledge three stages, those of mediational deficiency, production deficiency, and spontaneous production deficiency. Moreover, one cannot speak of the transitional period in mediational development. While

the three-stage model appears to be a valid one, it must be applied separately to various mode-elaborator combinations.

Finally, we were concerned with the mediational skills of ghetto children. Since our sample was somewhat above average in intelligence, we should exercise some caution in generalizing the results. The predictions based on white middle class performance were largely borne out, indicating the same patterns of mediational skill and efficacy are found at this age level in both populations. Labeling behavior takes place spontaneously, suggesting that associative learning dependent on concept or object labeling can occur in both groups. Spontaneous sentence verbalizations and imagery do not occur, although these strategies, if employed, lead to better performance than simple labeling. A production deficiency for imagery is present, but it also appears that some Ss who could produce imagery mediators decided not to do so. Ss in Condition B (imagery set, no mediator supplied) initially performed better than those under naming or control conditions, but they apparently abandoned this strategy after the initial trials. It is suggested that while Ss could produce imagery to their own advantage, this form of mediation was relatively unfamiliar to them. As a result, they experienced interference from the only strategy they spontaneously used (naming), and reverted to this approach on the final trials. This interpretation is consistent with

the Es' comments that this condition was most difficult for the Ss to learn. Several Ss even began trial 1 with naming the pictures and had to be reminded of the imagery instructions.

One final comment on the application of these results to school learning appears in order. The most elaborative forms of mediation produce greater learning--or at least performance--at this age, and will do so increasingly with advancing age. First graders are faced with a myriad of learning problems, many of an associative nature (C-A-T spells cat; 1 + 1 are 2, etc.). In addition to telling children what we want them to learn, why not tell them how to learn. Why not tell them what forms of mediation are most effective, demonstrate this with simple experiments they can understand, and give them experiences that encourage the development and adoption of the most effective learning strategies.

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TABLE 1

Performance Data on Apparent Efficacy and Mediational Ability on First Graders

Mediator Supplied	Performance (Apparent Efficacy)	References
Imagery vs. sentences	Higher-sentences-P.S. No difference-Gr. 1	Milgram, 1967; Rohwer, 1967 Milgram, 1967; Reese, 1965; Rohwer, 1967
Sentences vs. naming	Higher-sentences-Gr. 1 Higher-sentences-Gr. 2	Rohwer, 1967 Davidson, 1964
Naming vs. None	No difference-Gr. 1	Flavell et al., 1966; Kendler, 1963; Kendler et al., 1966
	No difference-Gr. 2	Davidson, 1964

Mode and Ability	Presence of Ability	References
Imagery		
Mediation	Yes	Rohwer, 1967
Production on request	?	
Spontaneous production	?	
Verbalization-sentences		
Mediation	Yes	Rohwer, 1967
Production on request	(Yes)	Jensen & Rohwer, 1967 (Gr.2-yes; K-no) Reese, 1969 (P.S.-yes)
Spontaneous production	No	Jensen & Rohwer, 1964
Verbalization-naming		
Mediation	Yes	Kendler et al., 1966
Production on request	(Yes)	Jensen & Rohwer, 1964 (Gr. 2-yes: K-no)
Spontaneous production	Yes	Kendler, 1963 Davidson, 1964 (Gr.2-yes) Jensen & Rohwer, 1964 (Gr. 2-yes; K-no)

TABLE 2

Paired-associate List

And Sentence Elaborations for Condition C

Stimulus Term	Response Term	Sentence Elaborations
flower	door	The flower knocked on the door.
iron	apple	The iron ate the apple.
cat	star	The cat sat on the star.
baby	mountain	The baby climbed the mountain.
bird	nail	The bird flew over the nail.
dress	clock	The dress fell on the clock.
bottle	flag	The bottle swallowed the flag.
tree	book	The tree read the book.
house	arm	The house stuck out its arm.
car	table	The car drove under the table.

TABLE 4

Mean Scores for the Seven Conditions on Trials 1 and 4

And Results of the Newman-Kuehls Multiple Range Test

Trial 1

F,G	E	B	A	D	C
2.4	2.6	3.4	5.3	5.6	5.8

Trial 4

F	B,G	E	D	A	C
4.5	4.9	5.5	7.5	7.6	8.8

Note.--Any two means underlined by the same line are not significantly different; $p < .01$.

TABLE 3

Analysis of Variance

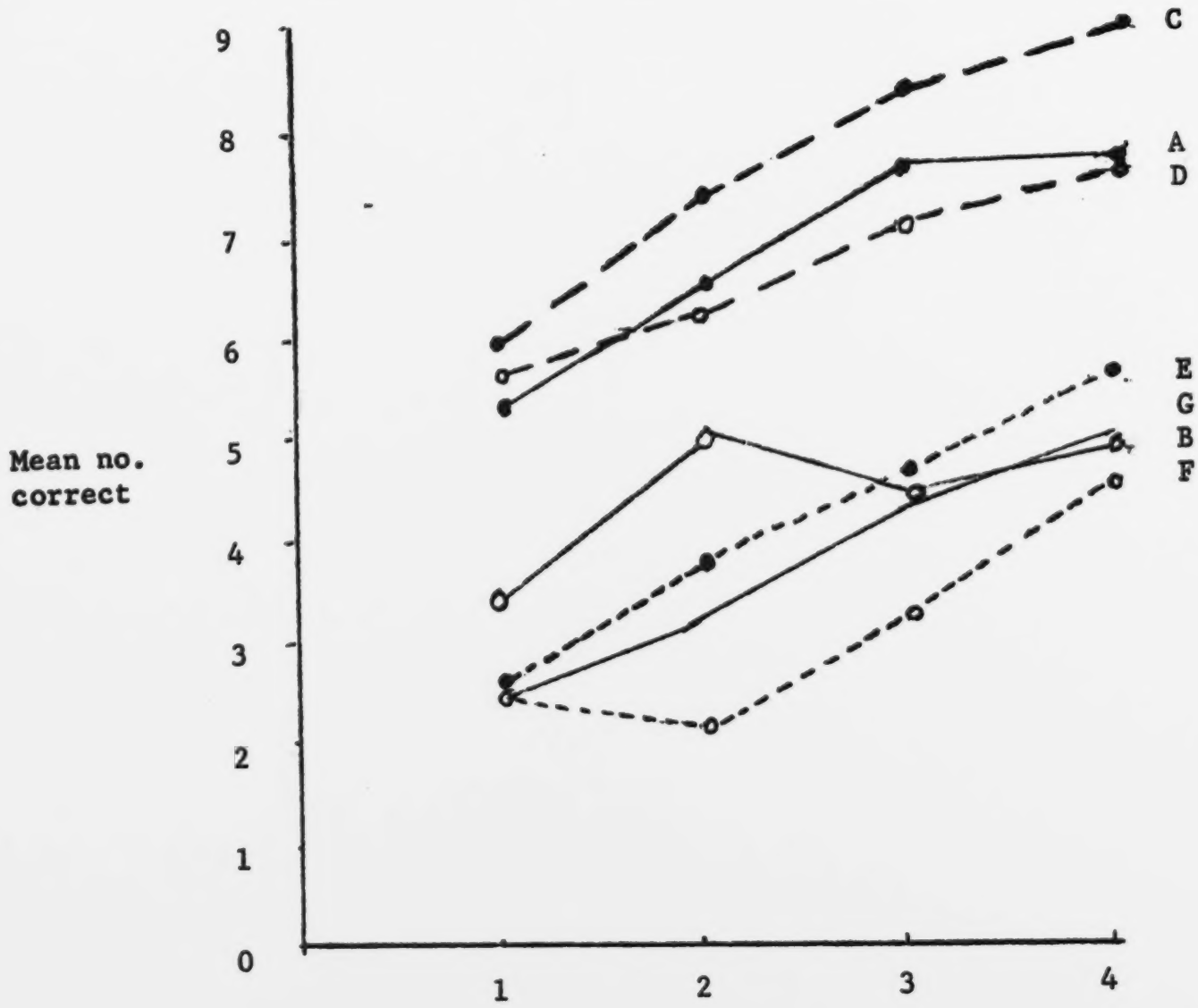
Of Number Correct in the Six Experimental Conditions, Trials 1-4

Source	*df*	Mean Square	*F*
Mediation set (M)	2	290.531	14.801***
Ability tested (A)	1	147.347	7.507**
M X A	2	12.733	1.542
Error	66	19.629	
Trials (T)	3	69.986	105.084***
T X M	6	2.531	3.800**
T X A	3	4.375	6.569**
T X M X A	6	1.399	2.101
Error	198	.666	

**$p<.01$; ***$p<.005$

FIGURE 1

Mean Number of Correct Scores for the Seven Conditions, Trials 1-4



KEY

Mediational Instructions

Imagery
Verbalization-Sentences
Verbalization-Naming
No mediational Instructions (control)

Mediator Supplied

A
C
E

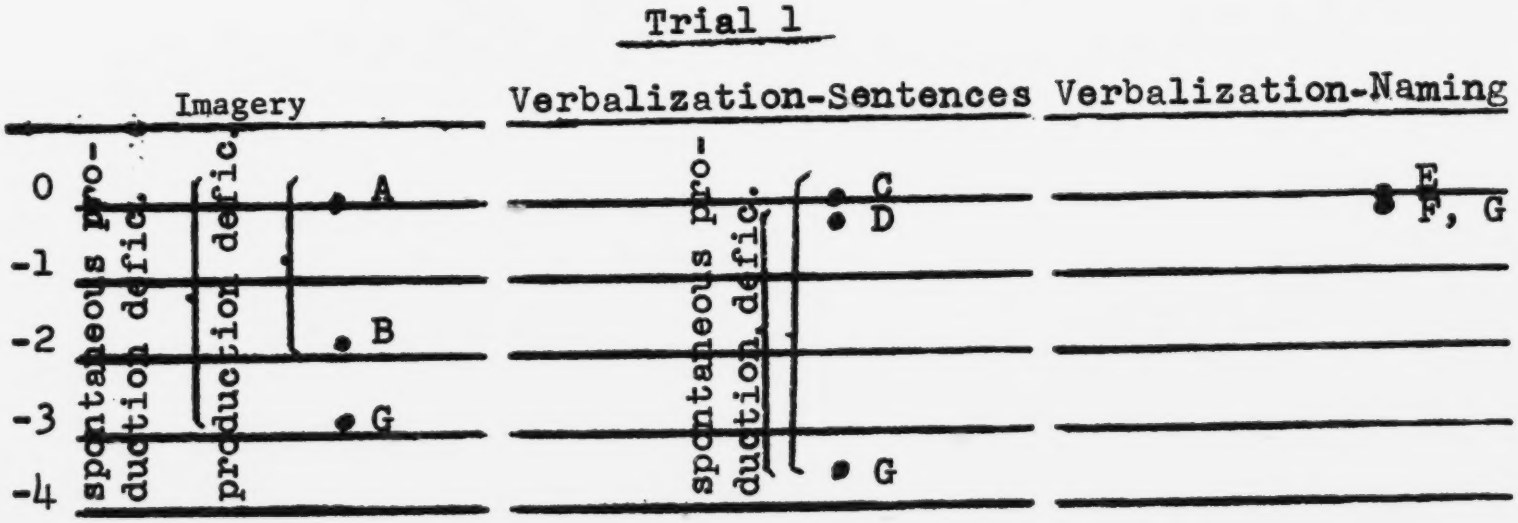
Mediator not Supplied

B
D
F
G

FIGURE 2

Ability Deficiencies in Three Types of Mediation, Trials 1 and 4

(Difference in mean number correct: mediational, production, and spontaneous production (control) abilities)



Note.--The tables show no ability deficiencies for naming mediation, a spontaneous production deficiency for sentential mediation, and a production-under-instruction and a spontaneous production deficiency for imagery.

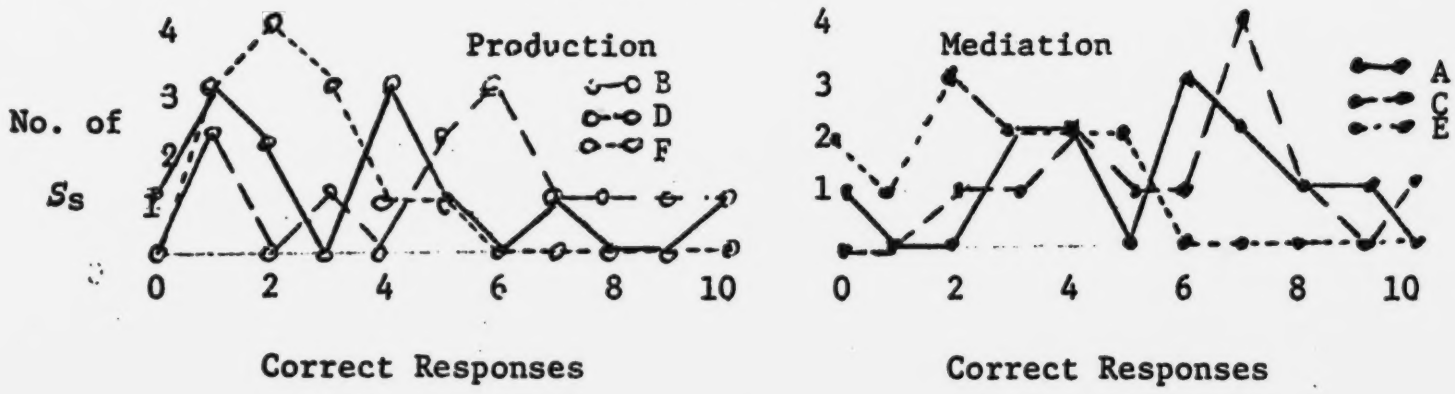
{ = significant difference ($p < .01$)

FIGURE 3

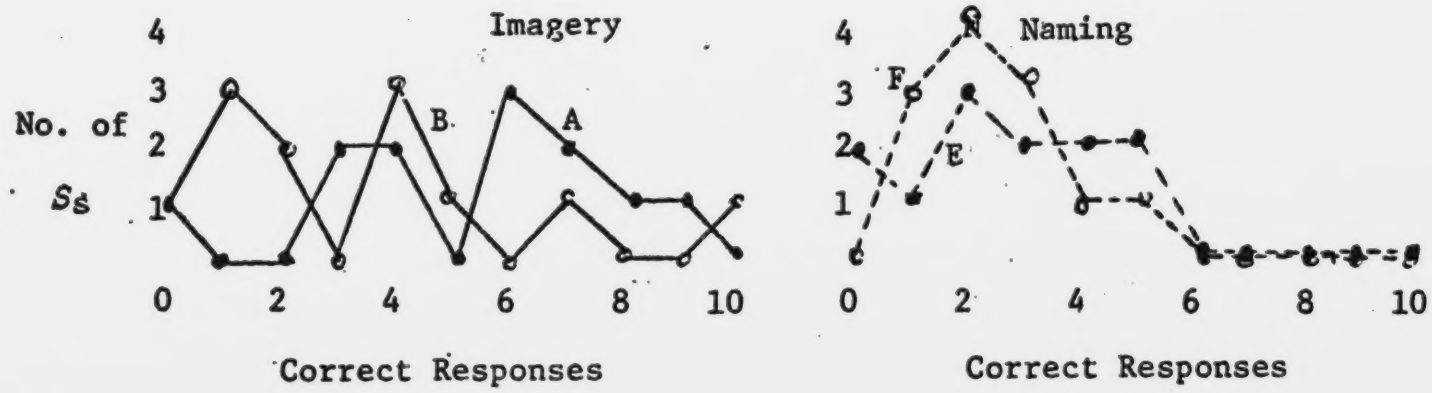
Frequency Distribution of Correct Responses

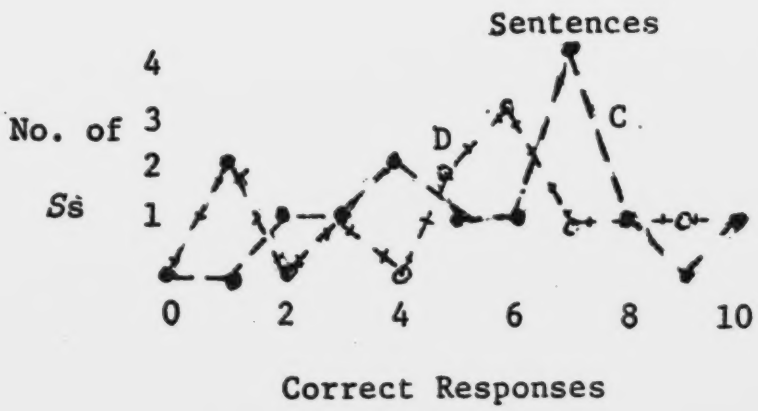
For the Six Experimental Conditions, Trial 1

Ability Tested--



Mediation Set-





APPENDIX A

Task Instructions

I'd like to show you how to play a new picture game. You can get candy for prizes. O.K.? The idea of the game is to learn which two pictures *always go together*. For instance, here are two pictures that always go together. (SHOW INSTRUCTION CARD #1 APPROPRIATE TO CONDITION--A SHIP AND A BUTTERFLY.)

CONDITIONS A-F ONLY

Other kids have found the best way to learn which pictures always go together is to--

(A, B) <u>make up a funny picture in your mind that combines both pictures.</u>

(A) What picture did you make up? (IF PROBE NEEDED: You could think of a picture of the ship sailing by the butterfly couldn't you?)

(B) What picture did you make up? (IF PROBE NEEDED: You could make up a picture of the ship sailing by the butterfly, couldn't you?)

(C, D) <u>make up a funny sentence that combines both pictures, and say it out loud or to yourself.</u>

(C) Here is the sentence, "The ship sailed by the butterfly."

(D) What sentence did you make up? (IF PROBE NEEDED: You could say, "The ship sailed by the butterfly," couldn't you?)

(E, F) <u>say the name of each picture out loud or to yourself several times.</u>

(E) Ship. Butterfly. (IF PROBE NEEDED: That's it--say them out loud or to yourself a few times.)

(F) (IF PROBE NEEDED: What's this. . .and this? That's it--say them out loud or to yourself a few times.)

Now, if I just show you this picture (PRESENT TESTING INSTRUCTION CARD #1 WITH RESPONSE TERM COVERED), what picture is missing? Sure, very good (EXPOSE PICTURES TOGETHER), you get a prize. (GIVE ONE PRIZE.) Let's practice again, and just like before, you try and remember the pictures that go together (CONDITIONS A-F: by . . .REPEAT APPROPRIATE INSTRUCTIONS). (PRESENT CARD #2, TEST REWARD, AND REPEAT WITH CARD #3.) Very good, now you know how to play the game. I think you're going to be very good at it, so let's begin. This time I'll show you 10 (pairs of) pictures, a little faster than before. After that, I'll ask you which pictures are missing. I'll ask you four times. You can have as many prizes as you get pictures right the fourth time. O. K.? Good. Now I'll show you the pictures. You try and remember which ones go together *the very same way that you did when we practiced.* (PRESENT STUDY CARDS APPROPRIATE TO CONDITION. ASIDE FROM GIVING SENTENCES UNDER CONDITION C AND NAMES UNDER CONDITION E, MAKE NO OTHER COMMENTS UNLESS THE *S* IS CLEARLY USING ANOTHER MEDIATION STRATEGY. IF, FOR EXAMPLE, A *S* UNDER CONDITION F IS GIVING SENTENCES, APPROPRIATE MEDIATING INSTRUCTIONS MAY BE REPEATED ONCE. PROCEED TO ANTICIPATION TRIALS AND RECORD RESULTS.)